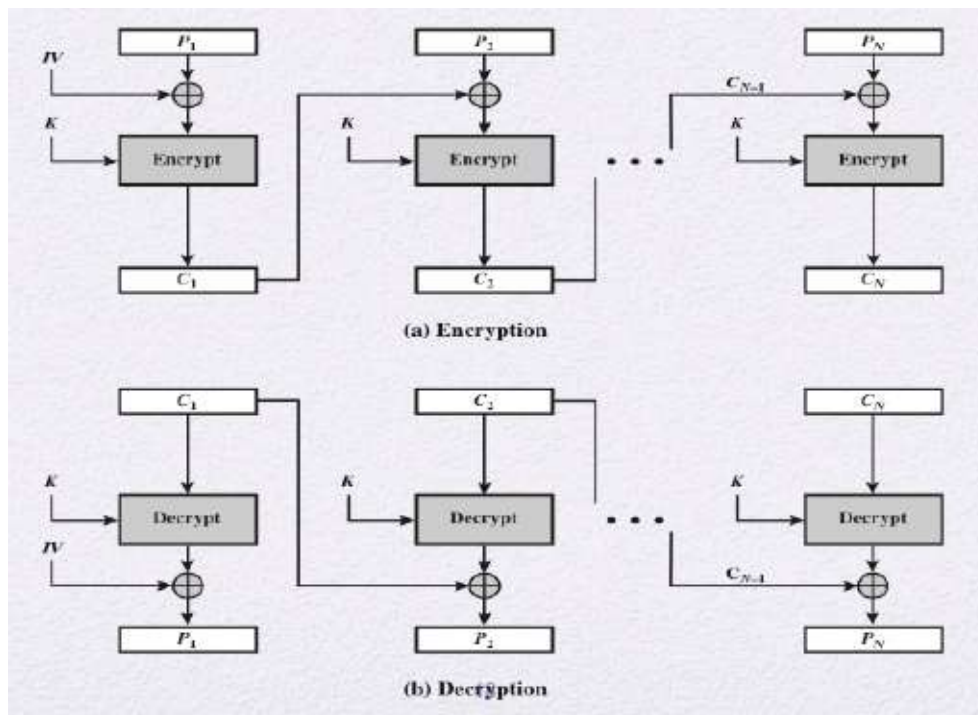


Performance and Security Analysis Between AES and RNA-DNA Image Encryption

● CBC Mode and ECB Mode:

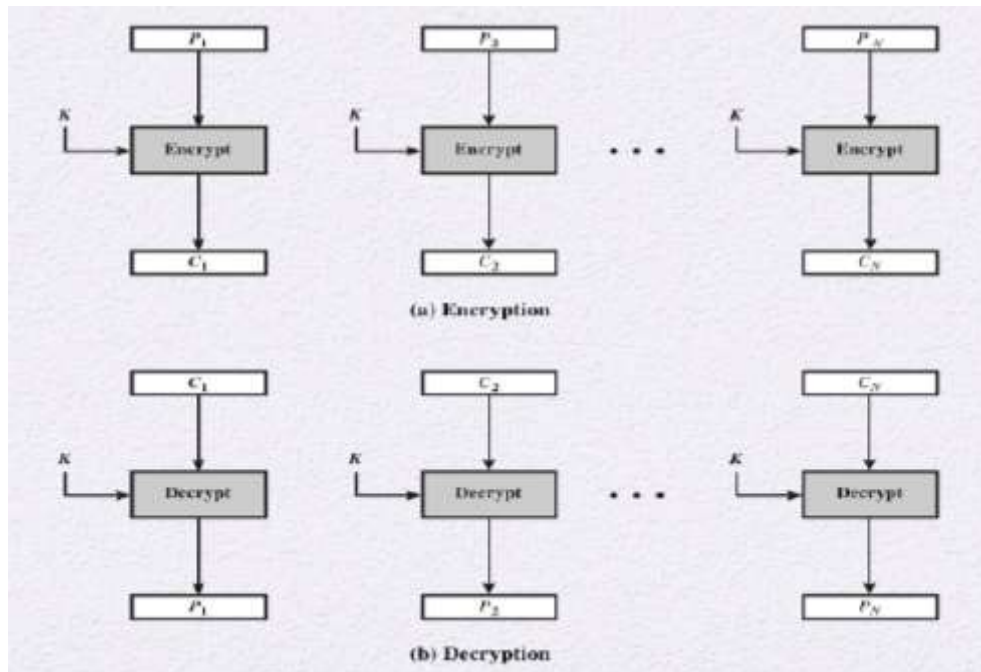
CBC (Cipher Block Chaining) Mode:

The input to the encryption algorithm is the XOR of the next block of plaintext and the preceding block of ciphertext.


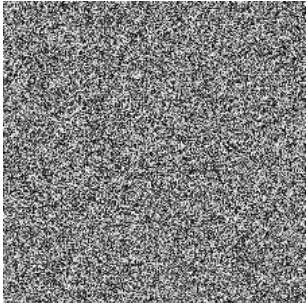
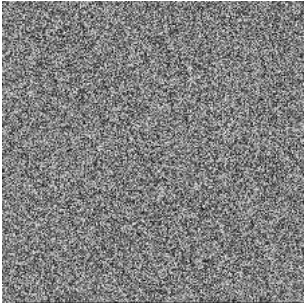
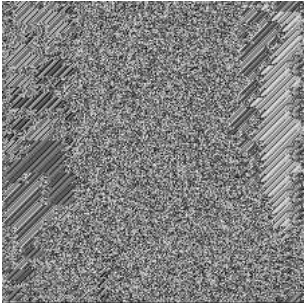


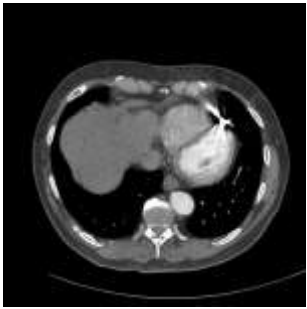
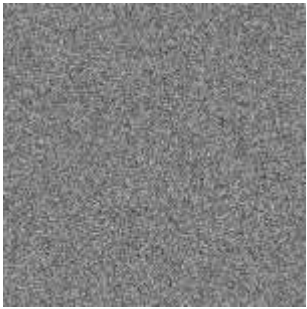
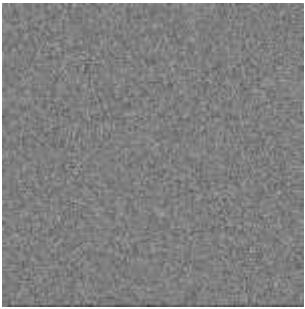
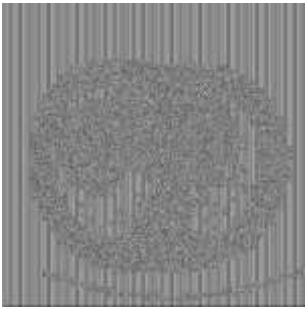
ECB (Electronic Codebook) Mode:


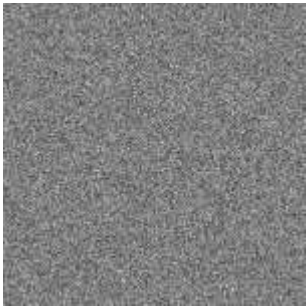
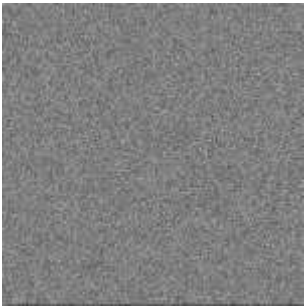

Each block of plaintext bits is encoded independently using the same key.


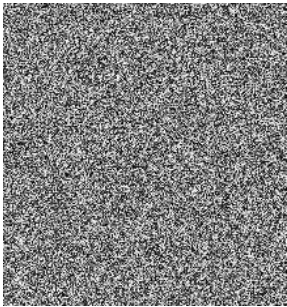
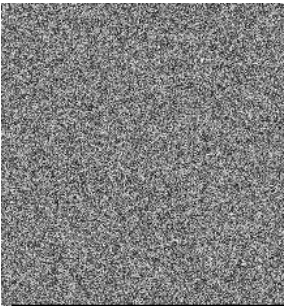
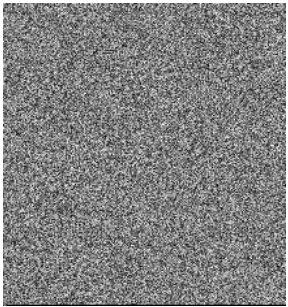


● **Result:**

Original (img10)	RNA-DNA	AES-CBC	AES-ECB
			

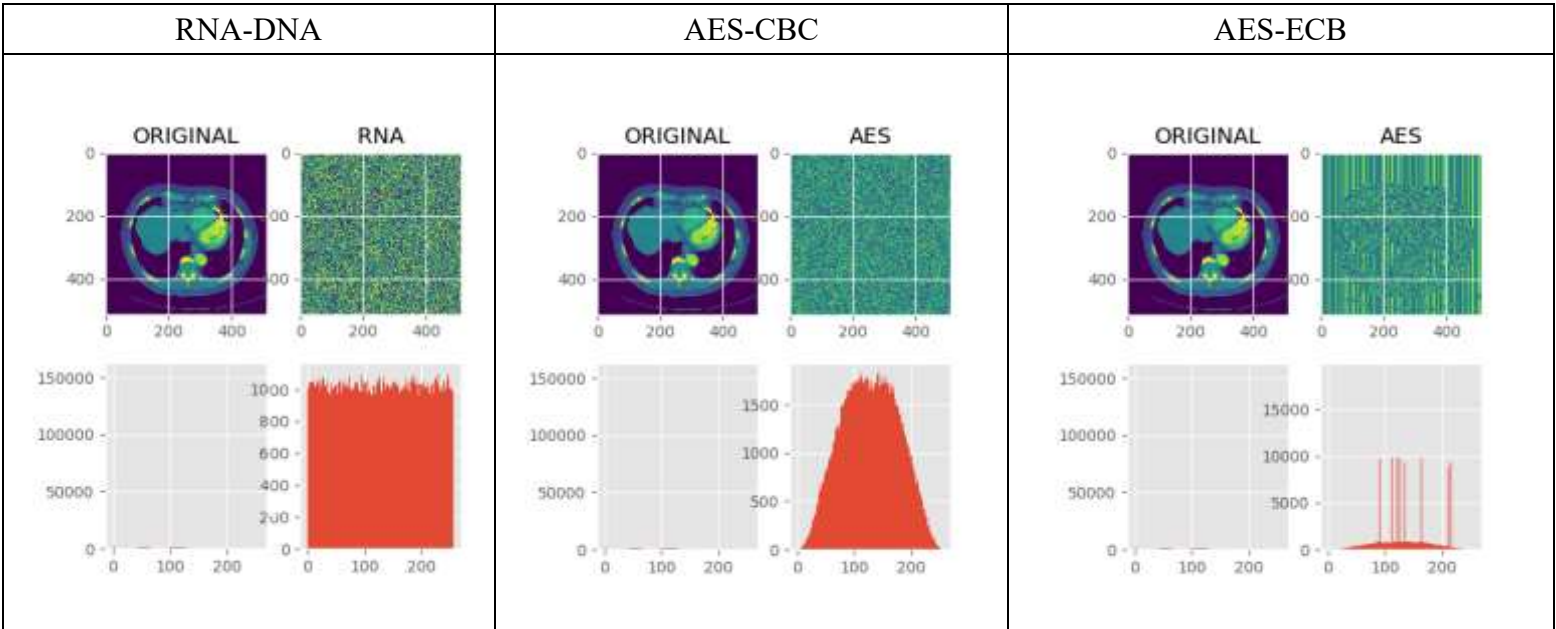
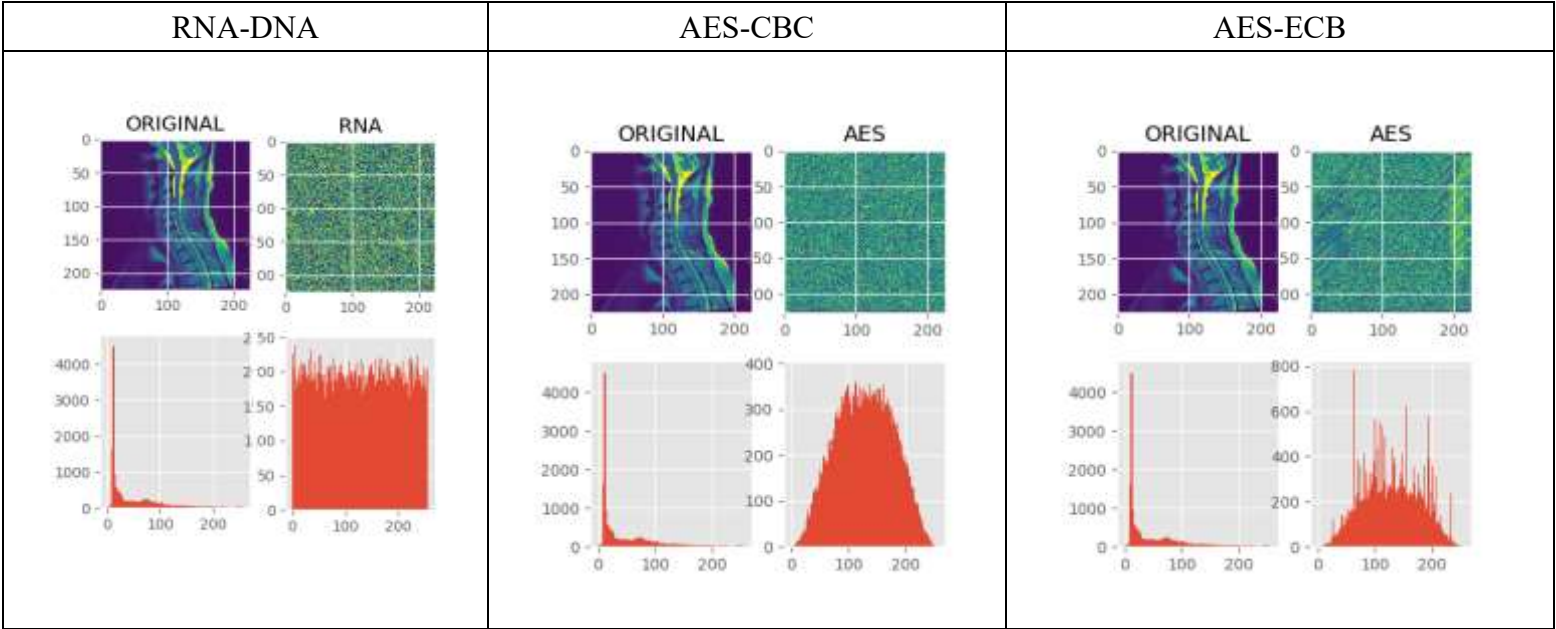
Original (img13)	RNA-DNA	AES-CBC	AES-ECB
			

Original (img17)	RNA-DNA	AES-CBC	AES-ECB
			

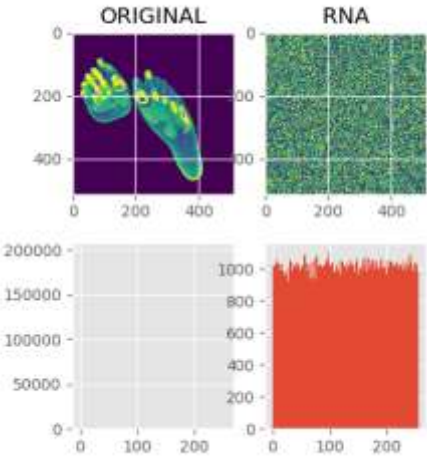
Original (img66)	RNA-DNA	AES-CBC	AES-ECB
			

A. Statistical Analysis

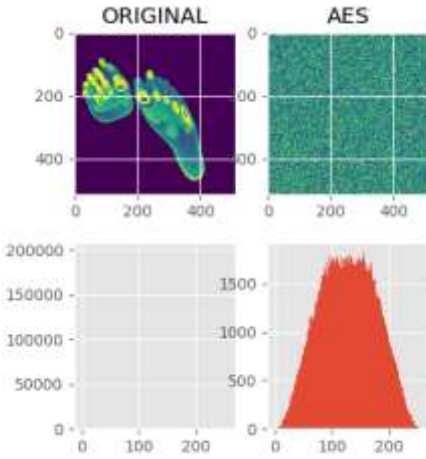
- 1) Histogram (provide any clue to employ any statistical analysis attack on the encryption image)



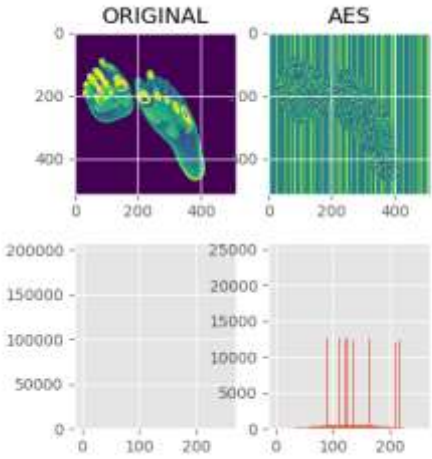
RNA-DNA



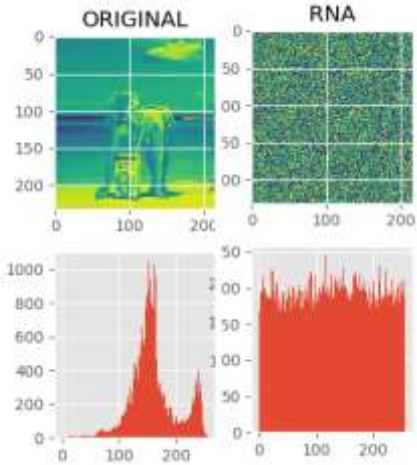
AES-CBC



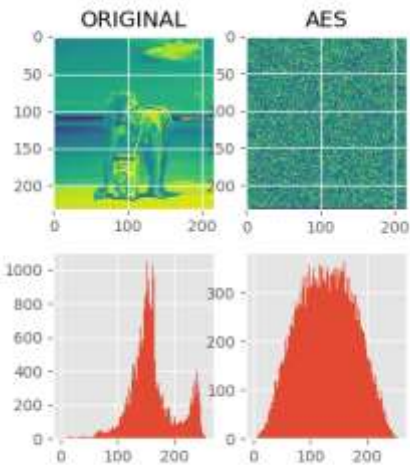
AES-ECB



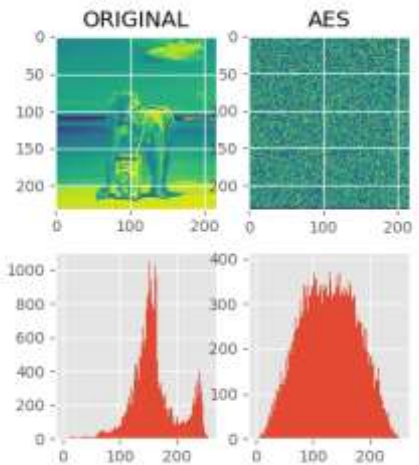
RNA-DNA



AES-CBC



AES-ECB

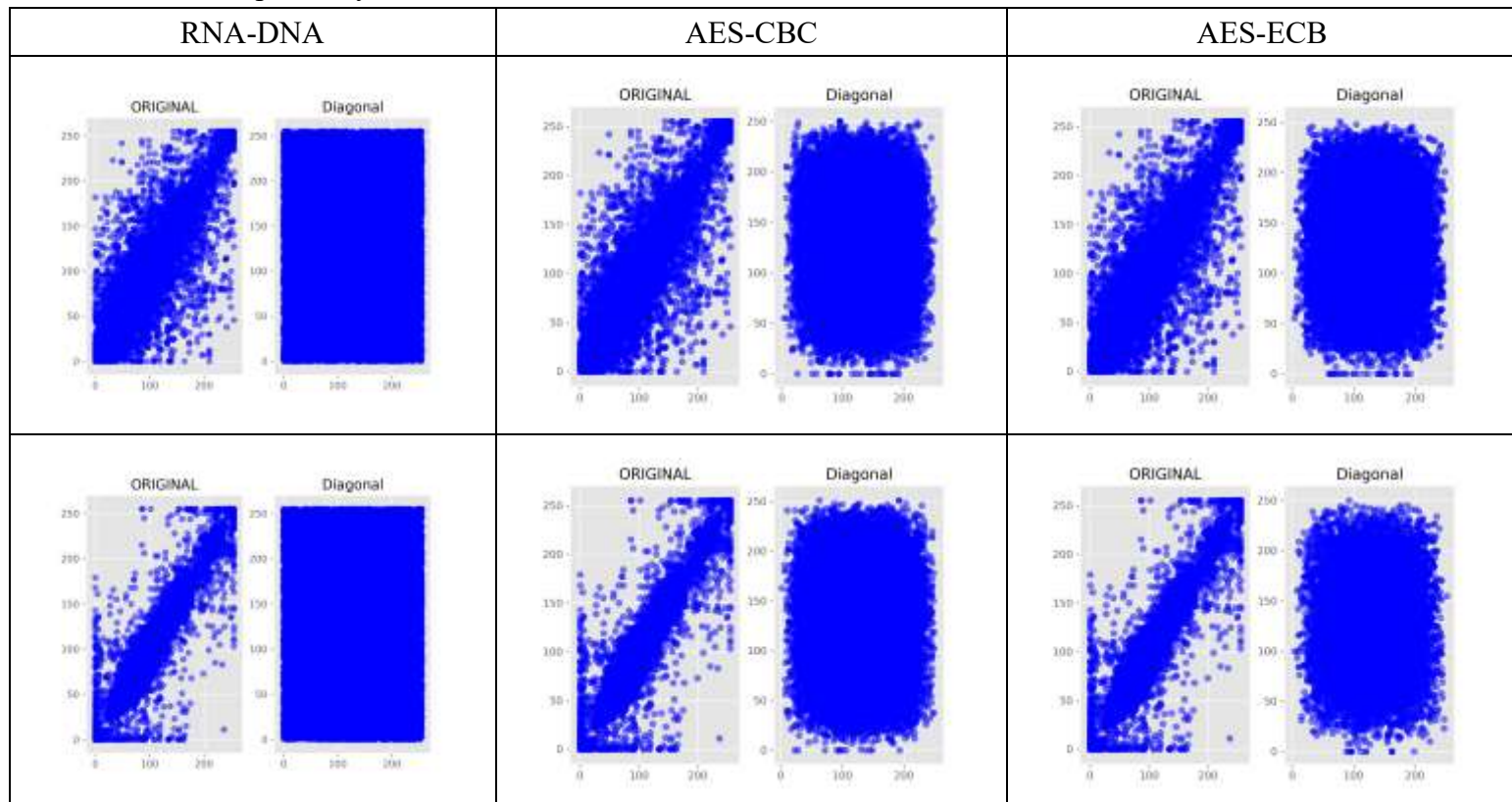


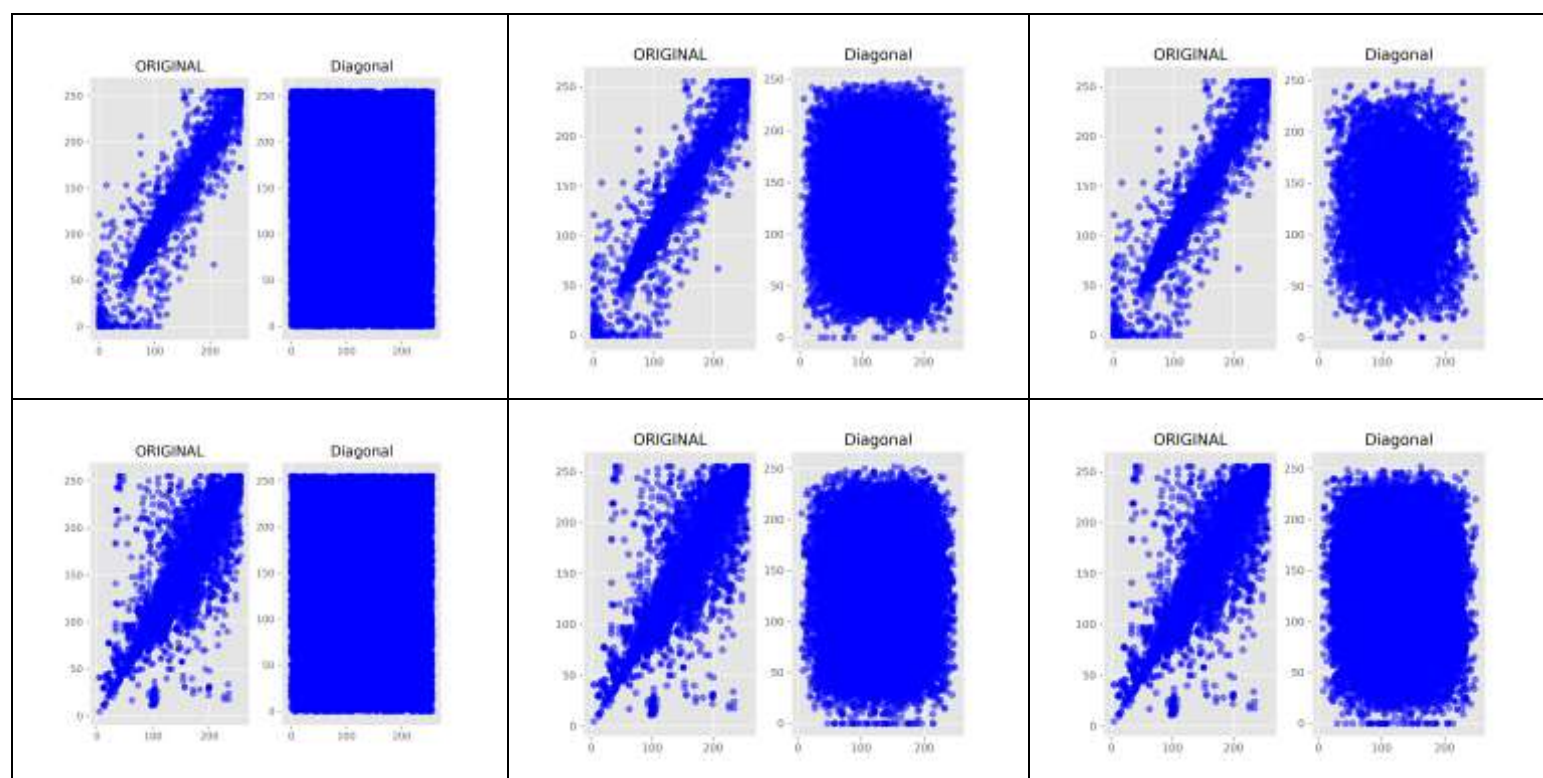
2) Correlation Analysis of Two Adjacent Pixels

Correlation Analysis of Ciphered Image

	Image	Horizontal	Vertical	Diagonal
10	RNA-DNA	-0.0069	-0.002	0.0183
	AES (CBC)	0.0213	-0.0143	-0.0071
	AES (ECB)	0.0261	0.0346	0.0721
13	RNA-DNA	0.0111	-0.0276	-0.0026
	AES (CBC)	-0.0044	0.0008	0.0061
	AES (ECB)	0.4743	-0.2188	-0.2159
17	RNA-DNA	0.0027	0.0163	0.0016
	AES (CBC)	0.0041	-0.0044	0.0058
	AES (ECB)	0.6981	-0.3189	-0.3115
66	RNA-DNA	0.0072	-0.0088	-0.006
	AES (CBC)	0.0079	-0.0115	-0.0015
	AES (ECB)	0.0156	-0.0355	0.0014

From top to down, show the correlation analysis result of image 10, 13, 17, 66, respectively.





B. Sensibility Analysis

1) Differential Attack(NPCR 、UACI)

Image 10

		RNA-DNA	AES-CBC	AES-ECB
NPCR	First Pixel	0.993837	0.998202	0.997985
	Middle Pixel	0.995556	0.998143	0.997985
	Last Pixel	0.999249	0.997807	0.997985
	Average	0.996214	0.998051	0.997985
UACI	First Pixel	0.325223	0.368982	0.369532
	Middle Pixel	0.349753	0.368192	0.369526
	Last Pixel	0.330117	0.369512	0.369514
	Average	0.335031	0.368895	0.369524

Image 13

		RNA-DNA	AES-CBC	AES-ECB
NPCR	First Pixel	0.995716	0.998158	0.998154
	Middle Pixel	0.994808	0.997948	0.998154
	Last Pixel	0.994713	0.998104	0.998154
	Average	0.995079	0.99807	0.998154
UACI	First Pixel	0.343997	0.400053	0.42544
	Middle Pixel	0.320209	0.400745	0.42544
	Last Pixel	0.34563	0.400653	0.425441
	Average	0.336612	0.400484	0.42544

Image 17

		RNA-DNA	AES-CBC	AES-ECB
NPCR	First Pixel	0.996143	0.99876	0.998787
	Middle Pixel	0.994698	0.998806	0.998787
	Last Pixel	0.986301	0.998749	0.998787
	Average	0.992381	0.998772	0.998787
UACI	First Pixel	0.346049	0.438359	0.472144
	Middle Pixel	0.336334	0.437683	0.472145
	Last Pixel	0.315538	0.437341	0.472145
	Average	0.332641	0.437794	0.472145

Image 66

		RNA-DNA	AES-CBC	AES-ECB
NPCR	First Pixel	0.997378	0.994657	0.993763
	Middle Pixel	0.996603	0.994498	0.993763
	Last Pixel	0.995789	0.994279	0.993763
	Average	0.99659	0.994478	0.993763
UACI	First Pixel	0.337181	0.225782	0.224649
	Middle Pixel	0.332696	0.226519	0.224662
	Last Pixel	0.31633	0.226515	0.224649
	Average	0.328736	0.226272	0.224654

2) Information Entropy Analysis

	Original	RNA-DNA	AES-CBC	AES-ECB
Image 10	6.19884089341	7.99617046439	7.63783426615	7.54539756786
Image 13	4.02843345403	7.99929526227	7.63878294346	6.40051673297
Image 17	2.64166441471	7.99930342855	7.63785855258	5.57253834808
Image 66	7.08471964285	7.99625431755	7.63612423939	7.63425886866

3) Time Analysis

	RNA-DNA	AES-CBC	AES-ECB
Image 10	2.826	0.005	0.011
Image 13	14.927	0.008	0.012
Image 17	14.883	0.017	0.007
Image 66	2.977	0.003	0.008